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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Karel
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Group Art Unit: 2833
Examiner: Ta, Tho Dac
Title: ELECTRIC CONNECTION FOR FUEL INJECTORS

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner For Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

A third Notice of Appeal in this application was filed on January 4, 2005. Appellant now submits its brief in the above-referenced application. No fee is due as Appellant previously paid for filing an appeal brief for this application.

Introduction

The §103 rejection that is the subject of this appeal must be reversed because there is no *prima facie* case of obviousness. There is no motivation for making the combination proposed by the Examiner because there is no benefit provided by the combination. Therefore, the combination cannot be made.

Real Party in Interest

Siemens VDO Automotive, Inc. is the real party in interest.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Claims

Claims 1-23 stand rejected under 35 U.S.C. §103.

Status of Amendments

There are no unentered amendments. No amendment was made after the most recent final rejection.

Summary of Claimed Subject Matter

Fuel injectors are used as part of the arrangement for providing fuel to an internal combustion engine in modern vehicles. Electrical connections with the appropriate portions of fuel injectors must establish the desired electrical contact in a manner that remains reliable throughout the expected service life of the vehicle fuel system. (Page 1, paragraph 3).

There are a variety of problems associated with conventional connection methods used for establishing electrical connections with fuel injector components. Typical connectors have an outer shell and a plurality of male pins that cooperate with a set of female connectors. Typical connector housings shield these pins from view once an attempted connection is made so that visual inspection is not possible. One difficulty associated with that situation is that the male or female connector parts may become bent or distorted before or during the attempted connection. Further, conventional connectors do not always provide a secure connection that lasts over the service life of the fuel system. (Page 1, paragraph 4).

Applicant's claimed invention provides an improved connection arrangement.

Independent claim 1 recites:

1. A fuel injector assembly, comprising:
a body portion that houses fuel injector components;
an electrical interface portion supported by the body portion; and
at least one deformable connector means supported on the interface portion, the deformable connector means having at least one edge for piercing and penetrating through an insulation covering on an electrical conductor to thereby electrically couple the interface portion to the electrical conductor.

One example fuel injector connection arrangement that claim 1 reads on is illustrated in Figures 1-4 and includes an electrical connection interface 24 that has at least one connector member 26 that facilitates making a reliable, visually observable electrical connection with a fuel injector. A support portion 30 of the connection interface 24 receives and supports a portion of a conductor 28 during an assembly process. The connector members 26 preferably are deformed so that at least one portion of each connector member pierces through an insulation layer 32 on the conductor 28 and forms an electrical coupling with a conductive portion 34 of the conductor 28. (Pages 2-3, paragraph 15-16).

In one example, the connector members 26 are barbs with pointed edges that pierce through the insulation layer 32 and engage the conductive portion 34. In one example arrangement, the connector members 26 are crimped into an electrically connected, conductive position. The electrical connection further makes a secure physical connection between the connection interface 24 and the conductor 28. (Page 3, paragraph 16).

Independent claim 4, which also reads on the embodiment described above, recites:

4. A fuel injector assembly, comprising:
a body portion that houses fuel injector components;
an electrical interface portion supported by the body portion;
at least one deformable connector member supported on the interface portion; and

at least one electrical conductor having an insulation covering on a conductive portion, the deformable connector member having at least one edge piercing through the insulation covering and making electrical contact with the electrical conductor.

Claims 6 through 9 read on embodiments that include a securing member placed over the conductor and the connector member. Those claims are reproduced here:

6. The assembly of claim 4, including a securing member placed over the conductor and the connector member.

7. The assembly of claim 6, wherein the securing member comprises plastic that is molded over the conductor and the connector member.

8. The assembly of claim 6, wherein the securing member comprises a seal.

9. The assembly of claim 6, wherein the securing member comprises at least one material selected from the group consisting of plastic, foam or silicone.

An illustrated example of such an arrangement shown in Figure 5 includes a covering 50 that covers over the connecting interface 24 and an associated portion of the conductor 28. One example covering 50 comprises molded plastic that is applied after the appropriate electrical connection has been made. Another example covering 50 is a seal that covers the connecting interface and provides a seal along the associated region of the fuel injector body 22 to prevent any contaminants from entering an opening in the body portion 22 adjacent the interface 24, where electrical connections to one or more components housed within the fuel injector body are made. The covering 50 prevents wear or deterioration over time due to environmental exposure. (Page 3, paragraph 17).

Claim 10, which depends from claim 4, covers embodiments having a flexible cable as the conductor.

10. The assembly of claim 4, wherein the conductor comprises a flexible conductor cable.

Claims 12 through 17 and 23 are method claims. Claim 12 recites:

12. A method of making an electrically conductive connection between an electrical interface on a fuel injector that has at least one deformable connector member and an electrical conductor, comprising the steps of:

positioning a portion of the conductor near the deformable connector member; and

deforming the deformable connector member to pierce through an insulation covering on the conductor and to establish an electrically conductive connection between the electrical interface and the conductor.

Claim 14 adds penetrating the conductor:

14. The method of claim 12, including at least partially penetrating the conductor with a portion of the deformable connector member to establish an electrically conductive coupling through the deformable connector member.

Method claims 15 through 17 read on processes that include placing a cover over the connector member and an associated portion of the conductor.

15. The method of claim 12, including covering the deformable connector member and an associated portion of the conductor after performing the deforming step.

16. The method of claim 15, including molding a plastic material onto the connector member and the associated portion of the conductor.

17. The method of claim 15, including placing a seal over the connector member and the associated portion of the conductor.

Grounds of Rejection to be Reviewed on Appeal

Claims 1-23 were rejected under 35 U.S.C. §103 over the proposed combination of U.S. Patent Nos. 5,584,704 (the *Romann, et al.* reference) and 5,137,468 (the *Murakami* reference).

Argument

There is no *prima facie* case of obviousness. There is no legal motivation for making the proposed combination of the *Romann, et al.* and *Murakami* references as discussed below. Even if the combination could be made, the result is not the same as many of Applicant's claims.

It is axiomatic that there must be a sufficient legal motivation from within the art to make a combination in order to establish a *prima facie* case of obviousness. Where there is no motivation, there is no *prima facie* case of obviousness.

In this instance, there is no motivation for making a combination between *Romann, et al.* and *Murakami* as proposed by the Examiner. Where a proposed combination does not provide any benefit (*i.e.*, merely includes a redundant feature or otherwise does not enhance the arrangement in the primary reference), there is no motivation for making the combination. Here, there is no motivation because the proposed additional features of *Murakami* provide no benefit to the arrangement of *Romann, et al.* and it is not even clear how they could be combined, given the teachings of the primary *Romann, et al.* reference.

The *Romann, et al.* reference discloses an arrangement where a printed circuit board 1 has a plurality of premanufactured holes 8 through which connector pins 9 of fuel injector valves 2 are received.

In column 4, the *Romann, et al.* reference teaches:

The printed-circuit board 1 has a plurality of connector-pin location holes 8 for contacting the fuel-injection valves 2. Projecting into these connector-pin location holes 8 of the printed-circuit board 1 are electrical connector pins 9 of the fuel-injection valves 2, which extend from a solenoid coil 10 (FIGS. 5 and 6) out of the fuel injection valve 2 and through which the solenoid coil 10 is excited. The connector-pin location holes 8 are already provided when the printed conductors 5 are produced on the printed-circuit board 1, so that contact difficulties are avoided later on. When there is one printed circuit board 1 for

triggering four fuel-injection valves 2 with two electrical connector pins 9 each, the result is eight connector-pin location holes 8.

...

A permanent electrical connection can be established between the connector pins 9 of the fuel-injection valves 2 and the printed conductors 5 of the printed-circuit board 1, for example, by means of soldering, welding or crimping, i.e., a solderless squeezing.

(Column 4, lines 12-24 and 33-37).

The *Romann, et al.* reference therefore teaches a specific way in which to connect the connector pins 9 to conductors 5 on a printed circuit board 1 that includes preset holes 8 for receiving the pins 9. The conductors 5 on the printed circuit board 1 have exposed ends at the openings 8, which are provided in the printed circuit board before the conductors 5 are etched onto the board in a conventional manner. The electrical connection between the pins 9 and the exposed ends of the conductors 5 is completed when the connector pins 9 are secured in the holes 8 by welding, soldering or by squeezing the pins 9.

The Examiner proposes to combine *Romann, et al.* and *Murakami* “to modify the invention of *Romann, et al.* by constructing the [pins] 9 as taught by *Murakami* in order to provide more reliable mechanical and electrical connection.” Such a modification provides no benefit and the combination cannot be made.

Romann, et al. already provides a connection technique that satisfies its requirements for coupling the pins 9 to the conductors 5 and there is no suggestion in either reference for substituting a connector as taught by *Murakami* into the configuration provided by *Romann, et al.*. There would be no benefit to using the type of connector taught by *Murakami* in *Romann, et al.*, because the primary reference already has exposed ends of the conductors 5 that are accessible by simply inserting the pins 9 through the holes 8. The conductors 5 do not have an insulation sheath (or other covering) that needs to be stripped off to make a connection with the conductors 5.

Therefore, the difference provided by making the modification suggested by the Examiner, which would introduce a sheath stripping connector instead of the pins 9, provides no benefit. There is no motivation to make the modification because it provides no benefit.

Additionally, it is not possible to make the combination because it does not provide a workable result. The type of connector used in *Murakami* is not suitable for a printed circuit board as used in *Romann, et al.* If one were to attempt to manipulate the *Murakami* crimping pieces 3 as taught by that reference, the printed circuit board 1, the conductors 5 or both from *Romann, et al.* would likely break in the process. The result would not be a good connection but, instead, would be a damaged circuit board or damaged conductors.

Additionally, the Examiner leaves much to the imagination as to how one would configure the proposed modified arrangement to incorporate the crimping pieces 3 of the connector of *Murakami* in order to make them fit through the holes 8 in *Romann, et al.* If one had to reconfigure the holes 8 to accommodate such crimping pieces, the holes would likely become unmanageably large given the size of the circuit board. Moreover, one would have to redesign the valves from which the pins 9 extend in order to accommodate the *Murakami* crimping pieces 3. Such redesign work is not only not reasonable but is wholly unsuggested by the art.

Perhaps the only explanation for the supposed motivation for making the proposed combination of *Romann, et al.* and *Murakami* is hindsight reasoning based upon Applicant's disclosure, which is of course not a permissible basis to for establishing a *prima facie* case of obviousness. There is nothing about the *Romann, et al.* reference that in any way suggests that it is not designed to provide a sufficient connection to meet its needs. Moreover, there is nothing in either reference that in anyway lends itself to giving rise to any suggestion for combining the

references. The combination cannot be made and none of Applicant's claims can be considered obvious.

Claims 1 - 3, 18 and 21 Stand Together and Are Patentable Separately From All Other Claims

As noted above, the proposed combination of the *Romann, et al.* and *Murakami* references cannot be made. Therefore, claim 1 and its dependents cannot be considered obvious.

Claims 4, 5, 10, 19, 20 and 22 Stand Togetherand Are Patentable Separately From All Other Claims

As noted above, there is no *prima facie* case of obviousness established against any of Applicant's claims because the Examiner's proposed combination cannot be made. Claim 4 is separately patentable from Claim 1, in part, because it is an independent claim and it positively recites a conductor in a specific relationship with the claimed deformable connector member.

Claims 6 - 9 Stand Together and Are Patentable Separately From All Other Claims

There is no *prima facie* case of obviousness against any of Applicant's claims for the reasons stated above. Further, claim 6 adds a securing member placed over the conductor and the connector member. Even if the Examiner's proposed combination could somehow be made, it still does not provide a securing member and the result would not be the same as the invention claimed in any one of claims 6 through 9.

Claims 12, 13 and 23 Stand Together and Are Patentable Separately From All Other Claims

As noted above, the proposed combination of the *Romann, et al.* and *Murakami* references cannot be made. Therefore, claim 12 and its dependents cannot be considered obvious.

Claim 14 Stands Alone and Is Patentable Separately From All Other Claims

Claim 14 adds at least partially penetrating the conductor with a portion of the deformable connector member, which is not shown in either of the references relied upon by the Examiner. The crimping pieces 3 in the Murakami reference do not penetrate a conductor, they only strip away the sheath and sit next to the conductor. Therefore, even if the combination could be made, the result is not the same as what is recited in claim 14.

Claims 15 - 17 Stand Together and Are Patentable Separately From All Other Claims

There is no *prima facie* case of obviousness against any of Applicant's claims for the reasons stated above. Further, claim 15 adds covering the deformable connector member and an associated portion of the conductor. Even if the Examiner's proposed combination could somehow be made, it still does not provide or even suggest what is claimed in any one of claims 15 through 17.

Conclusion

There is no *prima facie* case of obviousness because there is no motivation for making the Examiner's proposed combination and even if it were made, the result is not the same as many of Applicant's claims. The rejection must be reversed.

Respectfully submitted,

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March 4, 2005
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CERTIFICATE OF MAIL

I hereby certify that the enclosed **Appeal Brief** is being deposited with the United States Postal Service as First Class Mail, postage prepaid, in an envelope addressed to Mail Stop Appeal Brief - Patents, Commissioner For Patents, P. O. Box 1450, Alexandria, VA 22313-1450 on March 4, 2005.



Theresa M. Palmateer

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APPENDIX OF CLAIMS

1. A fuel injector assembly, comprising:
 - a body portion that houses fuel injector components;
 - an electrical interface portion supported by the body portion; and
 - at least one deformable connector means supported on the interface portion, the deformable connector means having at least one edge for piercing and penetrating through an insulation covering on an electrical conductor to thereby electrically couple the interface portion to the electrical conductor.
2. The assembly of claim 1, wherein the connector means includes a plurality of connector members, each comprising a barb of flexible metal material.
3. The assembly of claim 1, wherein the electrical interface portion at least partially extends outwardly and away from the body portion and the deformable connector member is outside of the body portion.
4. A fuel injector assembly, comprising:
 - a body portion that houses fuel injector components;
 - an electrical interface portion supported by the body portion;
 - at least one deformable connector member supported on the interface portion; and
 - at least one electrical conductor having an insulation covering on a conductive portion, the deformable connector member having at least one edge piercing through the insulation covering and making electrical contact with the electrical conductor.

5. The assembly of claim 4, including a plurality of connector members, each comprising a barb of flexible metal material.
6. The assembly of claim 4, including a securing member placed over the conductor and the connector member.
7. The assembly of claim 6, wherein the securing member comprises plastic that is molded over the conductor and the connector member.
8. The assembly of claim 6, wherein the securing member comprises a seal.
9. The assembly of claim 6, wherein the securing member comprises at least one material selected from the group consisting of plastic, foam or silicone.
10. The assembly of claim 4, wherein the conductor comprises a flexible conductor cable.
11. The assembly of claim 4, including a plurality of conductors and a corresponding plurality of deformable connector members.

12. A method of making an electrically conductive connection between an electrical interface on a fuel injector that has at least one deformable connector member and an electrical conductor, comprising the steps of:

positioning a portion of the conductor near the deformable connector member; and

deforming the deformable connector member to pierce through an insulation covering on the conductor and to establish an electrically conductive connection between the electrical interface and the conductor.

13. The method of claim 12, including crimping the deformable member onto the conductor.

14. The method of claim 12, including at least partially penetrating the conductor with a portion of the deformable connector member to establish an electrically conductive coupling through the deformable connector member.

15. The method of claim 12, including covering the deformable connector member and an associated portion of the conductor after performing the deforming step.

16. The method of claim 15, including molding a plastic material onto the connector member and the associated portion of the conductor.

17. The method of claim 15, including placing a seal over the connector member and the associated portion of the conductor.

18. The assembly of claim 2, wherein the plurality of connector members make electrical contact with a single electrical conductor.
19. The assembly of claim 5, wherein the plurality of connector members make electrical contact with a single conductor.
20. The assembly of claim 4, wherein the conductor comprises a flex cable.
21. The assembly of claim 1, wherein the connector means establishes a mechanical connection between the interface portion and the conductor.
22. The assembly of claim 4, wherein the connector member establishes a physical connection between the interface portion and the conductor.
23. The method of claim 12, including physically securing the fuel injector interface to the conductor when deforming the deformable connector member.

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